



US007214063B2

(12) **United States Patent**
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(10) **Patent No.:** **US 7,214,063 B2**
(45) **Date of Patent:** **May 8, 2007**

(54) **IMPLANT SYSTEM PARTICULARLY
USEFUL FOR FIXING DENTAL
PROSTHESES TO BONE**

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/171,386**

(22) Filed: **Jul. 1, 2005**

(65) **Prior Publication Data**

US 2006/0024644 A1 Feb. 2, 2006

(30) **Foreign Application Priority Data**

Jul. 29, 2004 (IL) 163284

(51) **Int. Cl.**
A61C 8/00 (2006.01)

(52) **U.S. Cl.** **433/174; 433/173; 433/175**

(58) **Field of Classification Search** **433/172-174**
See application file for complete search history.

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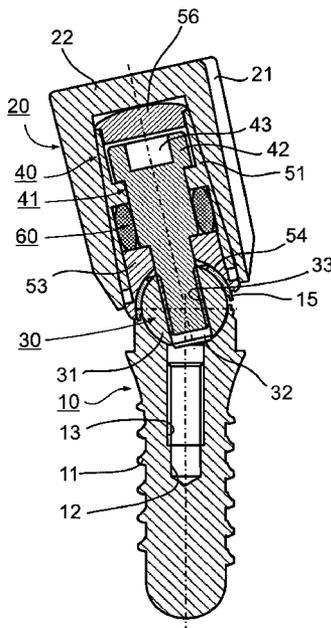
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(57) **ABSTRACT**

An implant system includes: an implant for implanting into a bone; an abutment to serve as a support for fixing a prosthesis to the bone; and a pivotal coupling between the implant and the abutment to permit, after the implant has been implanted into the bone, precise angulation in all directions of the abutment with respect to the implant before the abutment is fixed at the desired precise angulation with respect to the implant. Preferably, the pivotal coupling includes a ball-and-socket having complementary shaped contacting surfaces which are uneven to temporarily hold them in a direct pivoted position before permanently fixing them.

11 Claims, 5 Drawing Sheets



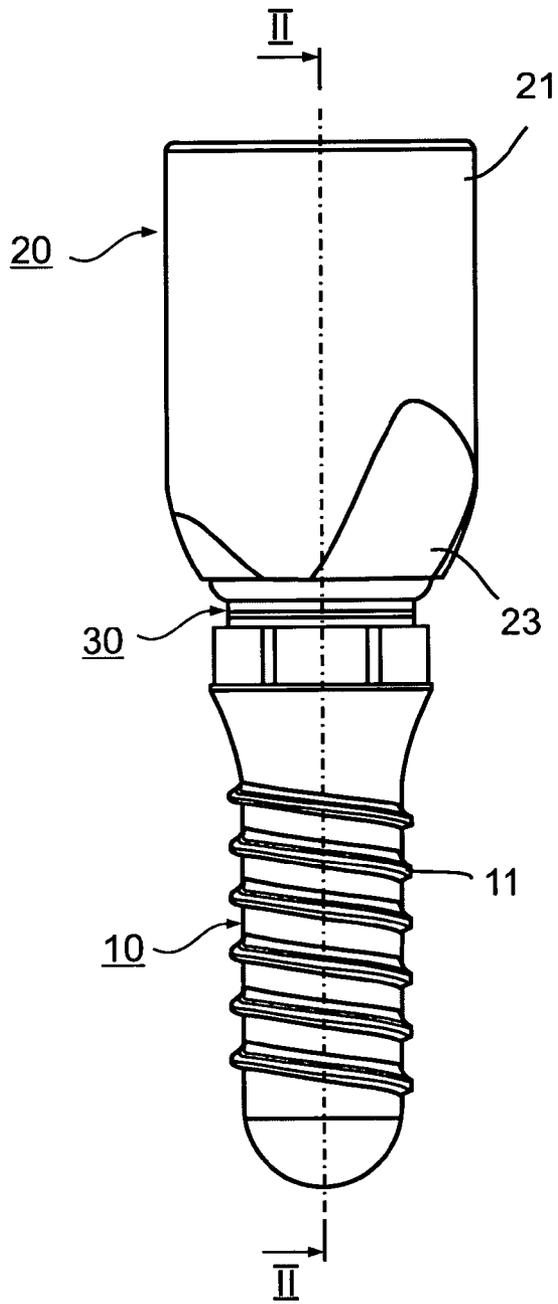


Fig. 1

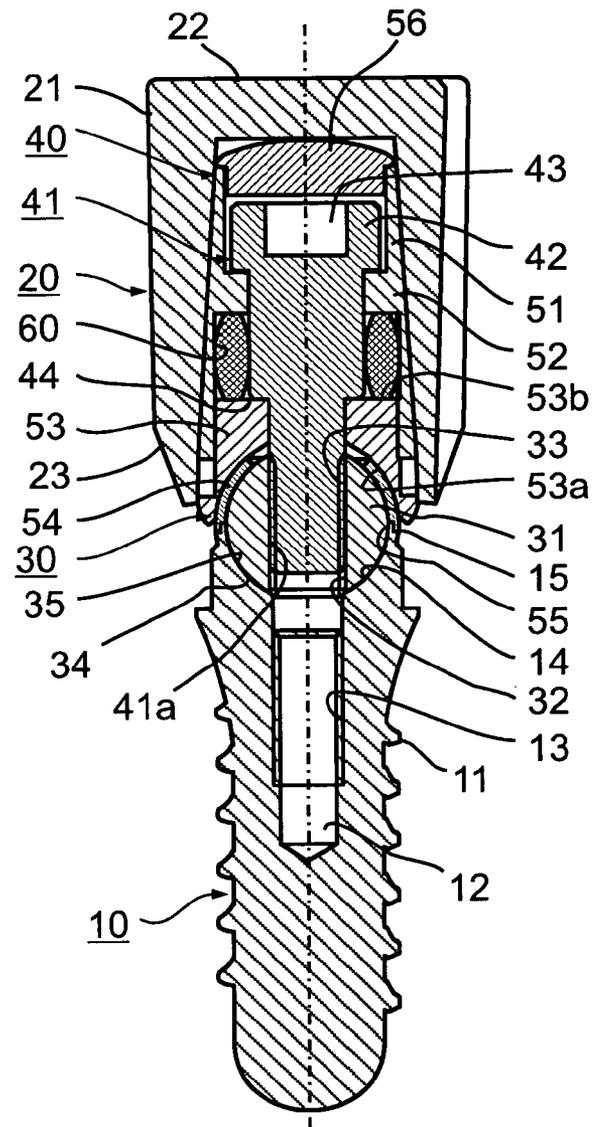


Fig. 2

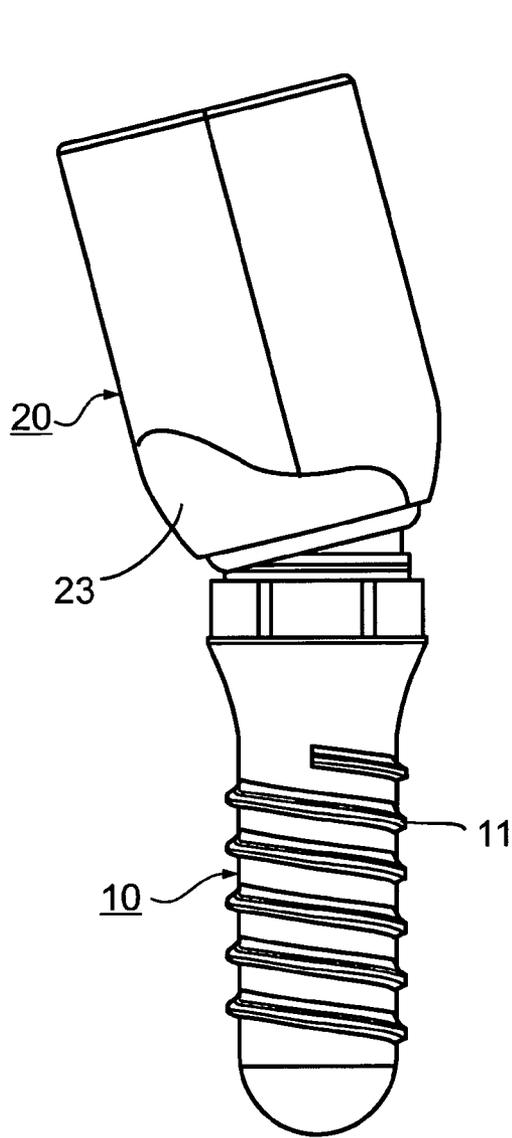


Fig. 3

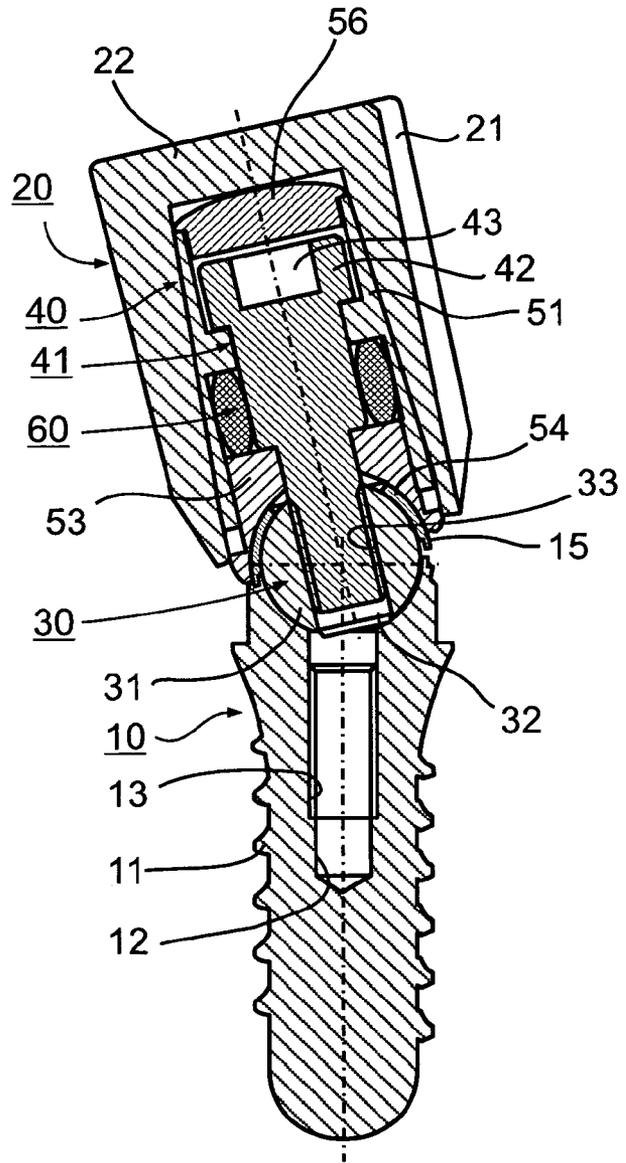


Fig. 4

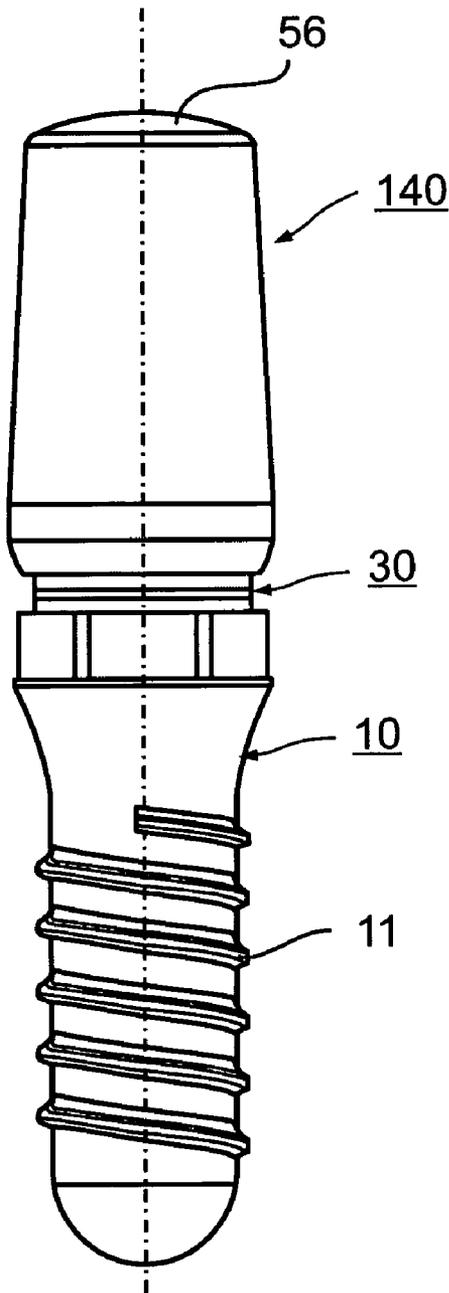


Fig. 5

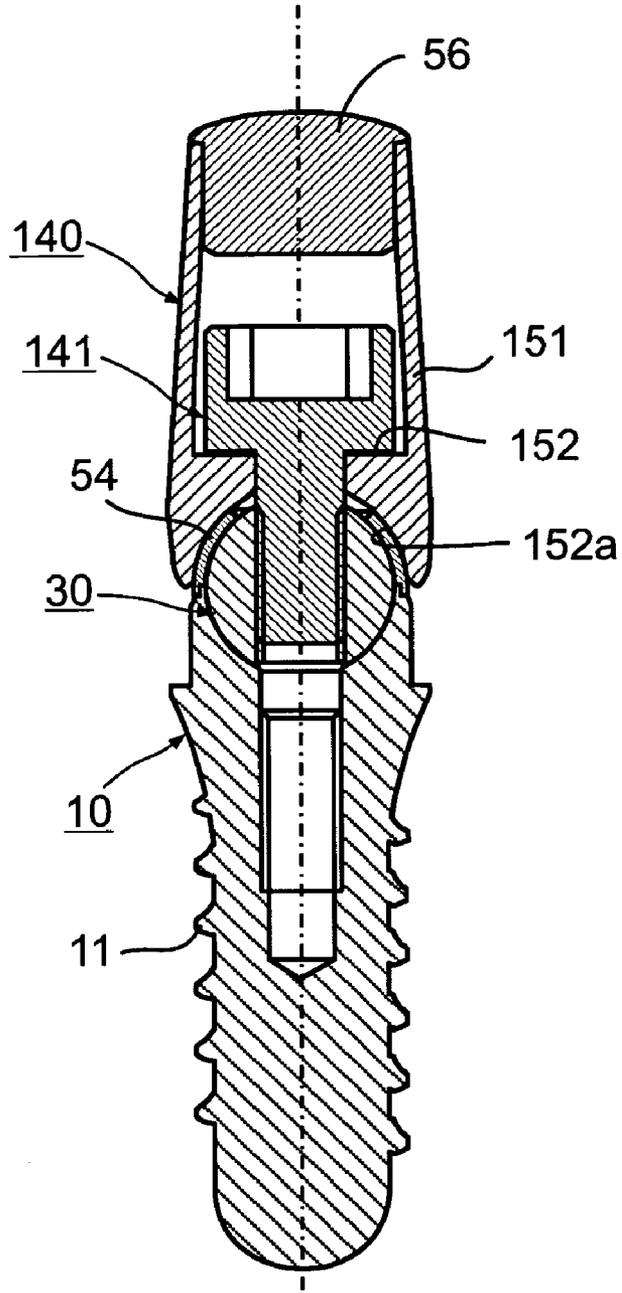


Fig. 6

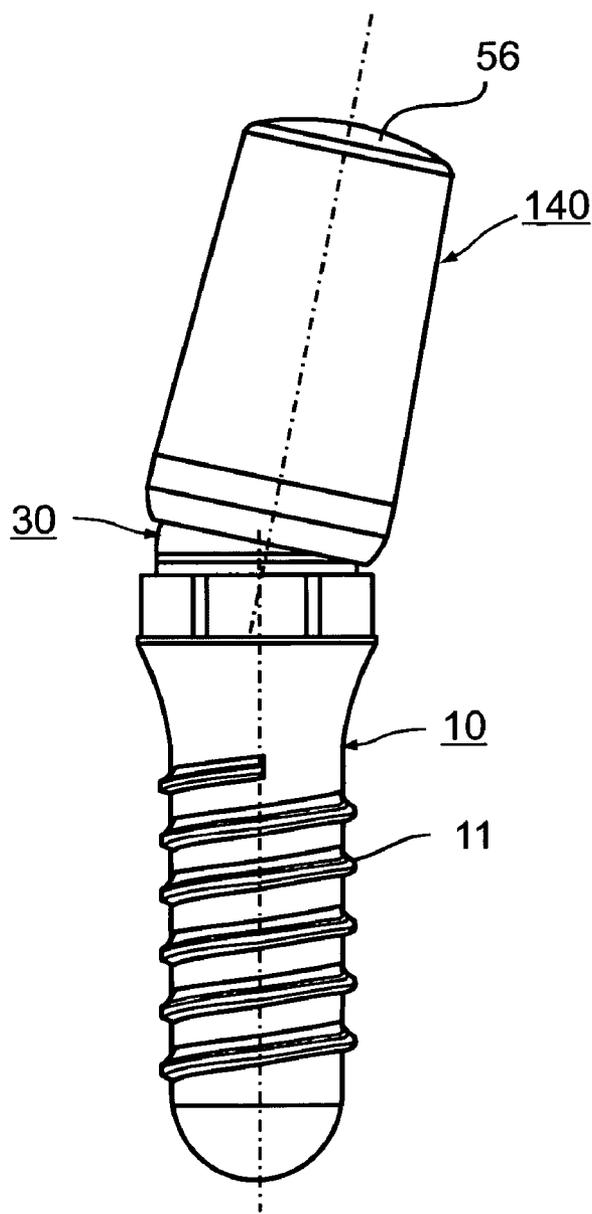


Fig. 7

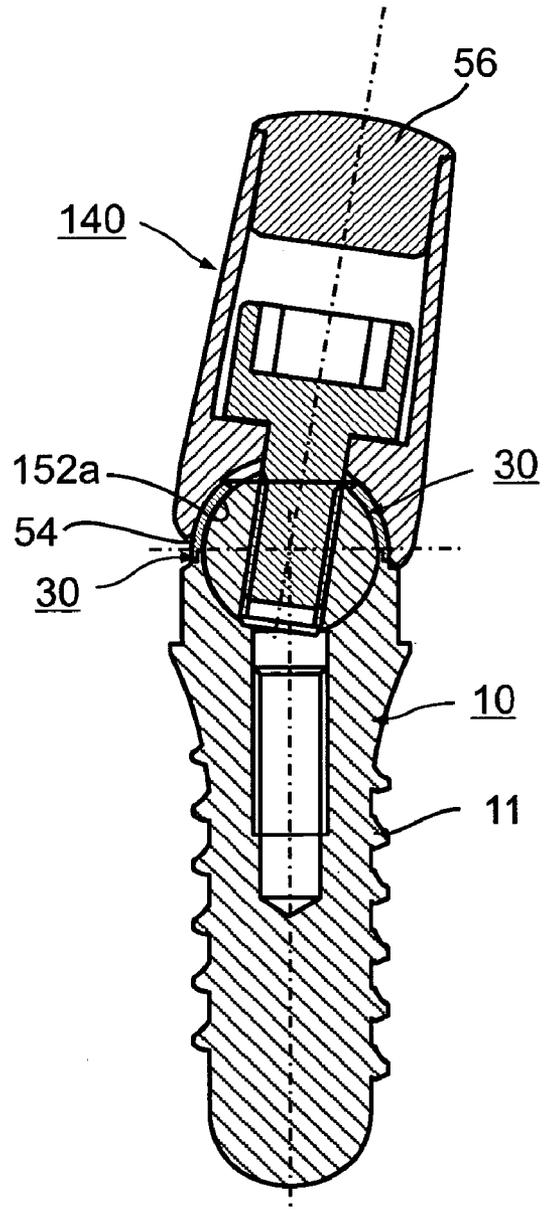


Fig. 8

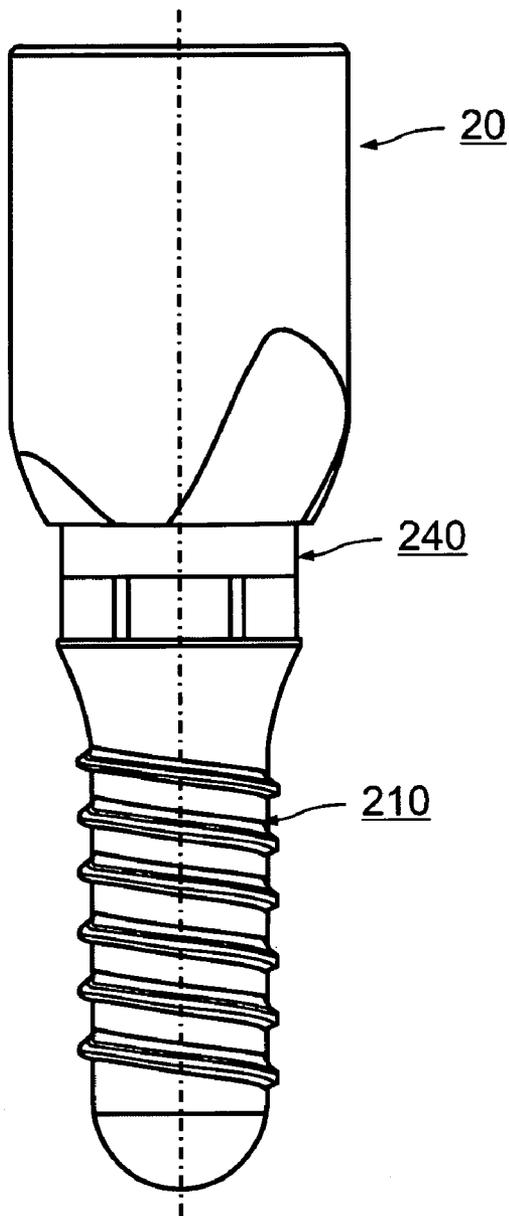


Fig. 9

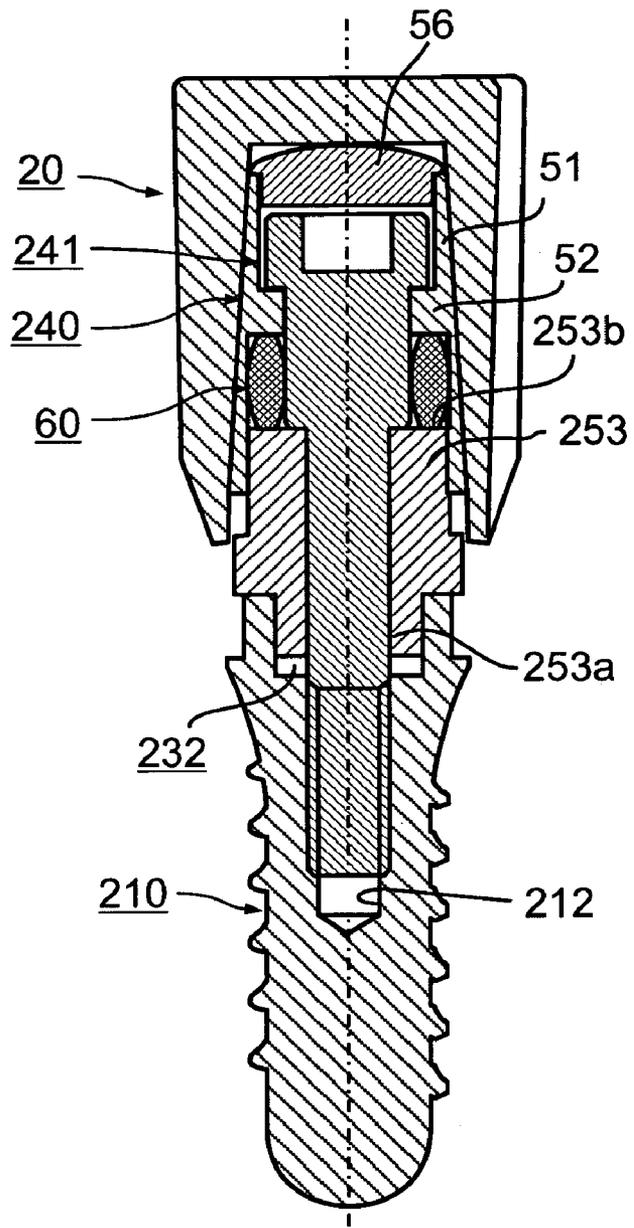


Fig. 10

1

IMPLANT SYSTEM PARTICULARLY USEFUL FOR FIXING DENTAL PROSTHESES TO BONE

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to implant systems for fixing various types of prostheses to bone. The invention is particularly useful for fixing a dental prosthesis to the lower or upper jawbone, and is therefore described below with respect to such an application, but it will be appreciated that the invention can be used in many other applications.

Implant systems are fast becoming an accepted mode for tooth replacement and/or for anchoring other types of dental prostheses to a jawbone. Such implant systems generally include an implant constructed for implanting into the bone, and an abutment constructed to serve as a support for fixing a prosthesis to the bone. A critical factor in a successful implant is the precise angulation of the abutment, which, among other factors, affects the ability of the resulting prosthesis to absorb shocks and distribute occlusal stresses to the bone/implant interface. A large number of implant systems have been developed to improve this ability, but efforts are continually being made to provide improved implant systems in this respect.

OBJECT AND BRIEF SUMMARY OF THE PRESENT INVENTION

An object of the present invention is to provide an implant system improving the ability of the resulting prosthesis to absorb shocks and distribute occlusal stresses.

According to one aspect of the present invention, there is provided an implant system, comprising: an implant constructed for implanting into a bone; an abutment constructed to serve as a support for fixing a prosthesis to the bone; and a pivotal coupling between the implant and the abutment to permit, after the implant has been implanted into the bone, precise angulation in all directions of the abutment with respect to the implant before the abutment is fixed at the desired precise angulation with respect to the implant.

It will thus be seen that such an implant system permits, even after the implant has been anchored into the bone, the abutment to be precisely angulated to its optimum position with respect to the implant before fixing the abutment to the implant.

According to further features in the described preferred embodiments, the pivotal coupling includes a ball-and-socket coupling. In one described embodiment, the ball-and-socket coupling includes complementary shaped contacting surfaces which are uneven to temporarily hold the ball-and-socket coupling in a desired pivoted position before permanently fixing the coupling in such position. In the described preferred embodiments, the ball-and-socket coupling is fixed in the desired pivotal position by an adhesive or by welding. Such an implant system may also include a shock absorber between the abutment and implant.

According to another aspect of the present invention, there is provided an implant system comprising: an implant constructed for implanting into a bone; an abutment constructed to serve as a support for fixing a prosthesis to the bone; and a shock absorber between the abutment and implant.

As will be described more particularly below, the shock absorber better enables the implant system to absorb shocks and distribute occlusal stresses to the bone/implant interface

2

more evenly than, e.g., metal-to-metal, ceramic-to-ceramic, or ceramic-to-metal implant components.

According to further features in one described preferred embodiment, the implant is formed with a threaded bore; the implant system further comprises a fixation screw having one end threaded into the bore and an opposite end fixed within the abutment; and the shock absorber is of annular configuration and encloses the fixation screw.

Further features and advantages of the invention will be apparent from the description below.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

FIG. 1 is a side elevational view illustrating one form of implant system constructed in accordance with the present invention;

FIG. 2 is a longitudinal sectional view of FIG. 1;

FIGS. 3 and 4 are views, corresponding to those of FIGS. 1 and 2, but showing the abutment in a pivoted position with respect to the implant;

FIGS. 5-8 are views corresponding to those of FIGS. 1-4, respectively, of another implant system constructed in accordance with the present invention; and

FIGS. 9 and 10 are views, corresponding to those of FIGS. 1 and 2, respectively, of a further implant system constructed in accordance with the present invention.

It is to be understood that the foregoing drawings, and the description below, are provided primarily for purposes of facilitating understanding the conceptual aspects of the invention and various possible embodiments thereof, including what is presently considered to be a preferred embodiment. In the interest of clarity and brevity, no attempt is made to provide more details than necessary to enable one skilled in the art, using routine skill and design, to understand and practice the described invention. It is to be further understood that the embodiments described are for purposes of example only, and that the invention is capable of being embodied in other forms and applications than described herein.

DESCRIPTION OF PREFERRED EMBODIMENTS

The Implant System of FIGS. 1-4

The implant system illustrated in FIGS. 1-4 includes an implant, generally designated 10, constructed for implanting into a bone; a prosthesis, generally designated 20 (an artificial tooth in this case) to be fixed to the implant; and an abutment, generally designated 40, serving as a support for fixing the prosthesis to the bone. The illustrated implant system further includes a pivotal coupling, generally designated 30, between the implant 10 and the abutment 40, to permit angulation in all directions of the abutment with respect to the implant after the implant has been implanted into the bone and before the prosthesis has been applied. As described more particularly below the illustrated constructions enables optimum angulation of the abutment before it is fixed with respect to the implant and before the prosthesis is fixed to the abutment.

Abutment 40 in the illustrated implant system includes a fixation screw 41, for fixing the abutment to the pivotal coupling 30, and a plurality of internal elements, identified by reference numerals starting with 50, within the abutment.

As will be described more particularly below, one of the internal elements within abutment **40** is a shock absorber **60** effective to absorb shocks and to distribute occlusal stresses to the bone/implant interface.

Implant **10** is of a solid cylindrical or conical configuration. It is formed with external threads **11** for fixing, by threading, the implant into a bore formed in the jawbone to receive the implant. The illustrated implant **10** is further formed with an axial bore **12** at its upper end, terminating substantially midway of its length. Bore **12** is threaded, as shown at **13**, to enable the implant in some cases to receive fixation screw **41** of abutment **40**. In the embodiment of FIGS. 1-4 (as well as in the embodiment of FIGS. 5-8), bore **12** is not actually used for receiving the fixation screw; but in the embodiment of FIGS. 9 and 10, as will be described more particularly below, bore **12** is used to receive the fixation screw for fixing the abutment to the implant.

The upper surface **14** of implant **10** is of a semi-spherical shaped configuration and serves as the socket for receiving the ball **31** of the pivotal coupling **30**. The outer circumference of semi-spherical socket **14** is preferably formed with an annular recess **15** to define an annular shoulder (**55**, FIG. 2) for a purpose to be described below.

Abutment **40** is constructed to serve as a support for fixing the prosthesis **20** via the implant **11** to the bone. Prosthesis **20** (in this case an artificial tooth as indicated above) includes a generally cylindrical section **21** closed at its upper end **22** and formed with tapering sides **23** at its lower open end. Prosthesis **20** is coupled by abutment **40** and the ball-and-socket coupling **30** to implant **10** such as to enable the abutment to be angulated to its optimum position with respect to the implant before the abutment is fixed, and the prosthesis applied to the abutment.

The ball-and-socket coupling **30** includes ball **31** received within semi-spherical socket **14** formed at the upper end of implant **10**. Ball **31** is formed with a central through-going bore **32** axially aligned with bore **12** of implant **10** in the normal upright position of abutment **40**. Bore **32** is threaded, as shown at **33**, for threadedly receiving fixation pin **41**, to thereby couple abutment **40** to ball **30**.

Fixation screw **41** of abutment **40** is formed with threads **41a** at one end, threaded into bore **32** of ball **31**. The opposite end of fixation screw **41** includes an enlarged head **42** formed with a non-circular (e.g., polygonal) recess or socket **43** to facilitate threading the screw into bore **32**. An intermediate portion of fixation screw **40** is of reduced diameter to define an annular shoulder **44**.

In addition to fixation screw **41**, abutment **40** further includes: a sleeve **51** formed with an internal annular shoulder **52** engageable with the underside of the enlarged head **42** of fixation screw **41**; a collar **53** engageable with annular shoulder **44** of the mid-portion of fixation screw **41**; and an insert **54** between the undersurface of collar **53** and ball **31**. The undersurface of collar **53** is formed with a spherical surface **53a** complementary to that of ball **31**. The two opposed faces of insert **54** are complementary to the spherical surface **53a** of collar **53**, and the portion of ball **31** which it contacts. As shown particularly in FIGS. 2 and 4, insert **54** is formed with the previously mentioned annular recess **55** about its outer circumference engageable with annular shoulder **15** of implant **10** to limit the pivotal movement of the ball-and-socket coupling **30**.

The internal elements within abutment **40** further include a cover **56** overlying the enlarged head **42** of fixation screw **41**.

As mentioned earlier and as also seen particularly in FIGS. 2 and 4, the internal elements within abutment **40**

further include an annular shock absorber **60** interposed between annular shoulder **52** of sleeve **51**, and the outer face **53b** of collar **53**. Shocks and other stresses applied to abutment **40** are absorbed by shock absorber **60** and are distributed by it and collar **53** before transmission by ball **31** and implant **10** to the bone carrying the implant.

It will thus be seen that after the implant system illustrated in FIGS. 1-4 has been implanted into the bone and before the prosthesis **20** has been applied, fixation screw **41** of abutment **40** may be pivoted, via ball-and-socket assembly **30**, to optimize the angulation of the abutment with respect to the implant. When the abutment angulation has been optimized, the position of the abutment may then be fixed in any suitable manner, e.g., by an adhesive or by welding; and the prosthetic device **20** may then be applied in the conventional manner.

Preferably (not necessarily) the contacting surfaces between the semi-spherical socket **14** and ball **31** are made uneven, e.g., by providing one with dimples or dentents **34** and the other with projections **35**. In this manner, the temporary positioning of abutment **40** may be facilitated, and the permanent fixing of the abutment in this position may be enhanced by adhesive or welding before fixing the prosthesis to the abutment.

It will also be seen that the shock absorber **60**, interposed between annular shoulder **52** of sleeve **51** and the upper surface **53b** of collar **53**, absorbs shocks and distributes occlusal stress to the bone/implant interface more evenly than rigid (e.g., metal-to-metal) implant components, as in the prior art.

The Embodiment of FIGS. 5-8

FIGS. 5-8 illustrate an implant very similar to that of FIGS. 1-4, but omitting the prosthesis **20** and the shock absorber **60**. Most of the remaining elements in the implant of FIGS. 5-8 are of basically the same structure, and operate in substantially the same manner, as described above with respect to FIGS. 1-4; therefore, in order to facilitate understanding, the corresponding elements have been identified by the same reference numerals, whereas the new or modified elements are identified by reference numerals beginning with "100".

Thus, the implant of FIGS. 5-8 omits the shock absorber **60** and the collar **53**, of FIGS. 1-4; therefore the following additional changes have been made: First, the fixation screw, therein designated **141**, is of shorter length than fixation screw **41** in FIGS. 1-4. In addition, sleeve **151**, formed with an internal annular shoulder **152** engageable with the underside of the enlarged head of fixation screw **141**, is also of shorter length, and its inner surface is of semi-spherical configuration as shown at **152a**. As in FIGS. 1-4, the outer end of sleeve **151** is closed by cover **56**.

Thus, while the implant illustrated in FIGS. 4-8 omits the shock absorber (**60**), and its collar (**53**), it retains the ball-and-socket mounting **30** between the implant **10** and abutment **140**, to permit optimum angulation of the abutment with respect to the implant after the implant has been implanted into the bone.

The Embodiment of FIGS. 9 and 10

FIGS. 9 and 10 illustrate an implant system, also similar to that of FIGS. 1-4, except that the ball-and-socket mounting **30** has been omitted. Again, to facilitate understanding, those elements generally corresponding to the elements described above with respect to FIGS. 1-4 are identified by the same reference numerals, whereas the new or modified elements are identified by reference numerals beginning with "200".

5

Thus, as seen particularly in FIG. 10, fixation screw 241 is elongated such that it extends into the threaded bore of the implant, therein designated 212 of implant 210, so as to be directly mounted to the implant. In addition, the implant 210 is formed with a socket 232 which is not semi-spherical, but rather is of a cylindrical configuration, for receiving an extension 253a of collar 253. As further shown in FIG. 10, the implant system also includes the annular shock absorber 60 interposed between the opposite face 253b of collar 253 and annular shoulder 52 formed in sleeve 51.

Accordingly, while the implant system illustrated in FIGS. 9 and 10 does not include the ball-and-socket mounting 30 of the two previously described embodiments, it does include the shock absorber 60, and thereby imparts to the implant system the ability to absorb shocks and distribute occlusal stress to the bone implant interface more evenly than e.g., metal-to-metal implant components.

While the invention has been described with respect to several preferred embodiments, it will be appreciated that these are set forth merely for purposes of example, and that many other variations, modifications and applications of the invention may be made.

What is claimed is:

1. An implant system, comprising:
 - an implant constructed for implanting into a bone;
 - an abutment constructed to serve as a support for fixing a prosthesis to the bone;
 - and a pivotal coupling between said implant and said abutment to permit, after the implant has been implanted into the bone, precise angulation in all directions of the abutment with respect to the implant before the abutment is fixed at the desired precise angulation with respect to the implant;
 - said pivotal coupling including a ball carried by said abutment, and a socket formed in said implant;
 - said ball being formed with a threaded bore, and said abutment comprising a fixation screw having one end threaded into said bore;
 - said fixation screw including an enlarged head, and said abutment further including a sleeve formed with an inner annular shoulder engaging said enlarged head of the fixation screw;
 - said fixation screw being formed with an annular shoulder between its threaded end and enlarged head;
 - said abutment further including a collar formed with a bore for receiving said threaded end of the fixation screw and engageable at its outer end with said annular shoulder of the fixation screw;
 - said collar being formed at its inner end with a spherical surface complementary to that of said ball.
2. The implant system according to claim 1, wherein said pivotal coupling includes complementary shaped contacting surfaces which are uneven to temporarily hold the ball-and-socket coupling in a desired pivoted position before permanently fixing them in such position.
3. The implant system according to claim 1, wherein said pivotal coupling is fixed in a desired pivotal position by an adhesive or by welding.

6

4. The implant system according to claim 1, wherein said abutment further includes a cover closing the outer end of said sleeve.

5. The implant system according to claim 1, wherein said abutment further includes an insert between, and complementary to, said spherical surfaces of said collar and said ball; said insert being formed with an annular recess about its outer circumference limiting against an annular shoulder formed on the outer circumference of said implant to limit the angulation of said abutment with respect to said implant.

6. The implant system according to claim 1, wherein said implant system further comprises an annular shock absorber enclosing said fixation screw and engageable on its opposite sides by said collar and said annular shoulder of the sleeve.

7. The implant system according to claim 1, wherein said fixation screw includes an enlarged head at said opposite end engaged by an inner annular shoulder formed in said abutment for fixing said fixation screw within said abutment.

8. The implant system according to claim 7, wherein said abutment is formed at its inner end with a spherical surface complementary to that of said ball.

9. The implant system according to claim 8, wherein said abutment further comprises an insert between, and complementary to, said spherical surfaces of said abutment and said ball; said insert being formed with an annular recess about its outer circumference limiting against an annular shoulder formed on the outer circumference of said implant to limit the angulation of said abutment with respect to said implant.

10. An implant system, comprising:

- an implant constructed for implanting into a bone;
- an abutment constructed to serve as a support for fixing a prosthesis to the bone;
- and a shock absorber between said abutment and implant;
- said implant being formed with a cylindrical socket and a threaded bore;
- said abutment including a fixation screw having one end threaded into said bore and an opposite end enclosed by said shock absorber;
- said fixation screw including an enlarged head at said opposite end fixed within said abutment by a sleeve formed with an inner annular shoulder engaging said enlarged head;
- said fixation screw being formed with an annular shoulder between its threaded end and enlarged head;
- said abutment further including a collar formed with a bore for receiving said threaded end of the fixation screw;
- said collar being engageable at its outer end with said annular shoulder of the fixation screw for fixing it within said abutment and including an extension at its opposite end receivable within said socket of said implant and.

11. The implant system according to claim 10, wherein said abutment further includes a cover closing the outer end of said sleeve.

* * * * *